

VEHICLE LAMP

FIELD OF THE INVENTION

[0001] The present invention relates to a lamp, in particular a tail light, for vehicles, preferably motor vehicles.

BACKGROUND OF THE INVENTION

[0002] In a known lamp of this kind (DE 195 47 861), an incandescent lamp is arranged in the housing behind the light disk in a larger chamber and an LED behind a light-conducting element in a smaller chamber. The LED emits towards the light disk. The reflection part is arranged in front of the LED. Hence, the lamp has a corresponding structural depth.

SUMMARY OF THE INVENTION

[0003] An object of the invention is so to configure a lamp of this kind that it will have but little structural depth and a high optical efficiency.

[0004] In the lamp according to the invention, the LED emits its light to a large extent laterally. The reflection part surrounding the LED picks up this light completely and reflects it towards the light disk of the lamp. The height of the reflection part can, therefore, correspond to the height of the LED. As a result, the reflection part and hence the lamp has but little structural height, so that the lamp can be accommodated in flat installation spaces without problems. Even so, an optimal emission of light is achieved, since the reflection part picks up almost

100% of the quantity of light emitted by the LED and reflects it towards the light disk. Furthermore, it will suffice to use only a single LED. Hence, the lamp can be simply and economically produced.

[0005] Other features of the invention will appear from the additional claims, the description of the figures, and the drawings.

[0006] Further areas of applicability of the present invention will become apparent from the detailed description provided hereinafter. It should be understood that the detailed description and specific examples, while indicating the preferred embodiment of the invention, are intended for purposes of illustration only and are not intended to limit the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The present invention will become more fully understood from the detailed description and the accompanying drawings, wherein:

[0008] Fig. 1 shows a part of a lamp according to the invention having a luminous medium and a reflector in axial section;

[0009] Fig. 2 shows an alternate embodiment of a lamp in accordance with the present invention;

[0010] Fig. 3 shows a further alternative embodiment of a lamp in accordance with the present invention;

[0011] Fig. 4 shows another alternative embodiment of a lamp in accordance with the teachings of the present invention;

[0012] Fig. 5 shows a still further alternative embodiment of the teachings of the present invention; and

[0013] Fig. 6 shows an additional alternative embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0014] The following description of the preferred embodiment(s) is merely exemplary in nature and is in no way intended to limit the invention, its application, or uses.

[0015] Fig. 1 shows part of a motor vehicle tail light having a parabolic reflector 1, at the focus of which the luminous means 2, in the form of an LED 2, is arranged. The reflector land the LED 2 are provided in a housing (not shown) of the tail light, having a housing aperture closed in known manner with a light disk (likewise not shown) through which the light exits to the outside. The LED 2 is seated on a base 3 held to the housing. The LED 2 has a light-conducting element 4 more or less in the shape of a double cone, and encircling ribs 5 projecting outward at half-height, at which the light rays L leaving the LED 2 are so deflected laterally that almost all of the light is emitted laterally. Such LEDs are known and, therefore, need not be described in more detail. The reflector 1 is drawn up so far that all light rays L reach the inside 6 of the reflector land are reflected to the light disk of the lamp. In the embodiment by way of example, the light rays L are reflected parallel to each other and impinge on the light disk perpendicularly.

[0016] The reflector surface 6 is of smooth configuration. Alternatively, however, it may exhibit so-called cushion and/or roller structure, at which the incident rays L are scattered. Again, it is possible to arrange an optical disk in the region between the reflector land the light disk.

[0017] Since the LED 2 emits light laterally only, the reflector 1 may be of flat construction. Thus, an optimal light yield of nearly 100% is possible. The LED 2 has a long life, is inexpensive, and develops but little heat as a rule.

[0018] As shown in Fig. 2, instead of a reflector, a light-conducting element 1a may be provided. The LED 2 is seated in its central aperture 12. The light-conducting element 1a has a circular outline and but little thickness. The LED 2 projects only slightly beyond the element 1a. The ribs 5 of the LED are of such configuration that they deflect the light rays L obliquely downward at a flat angle. The light rays L exiting beyond the compass of the two ribs 5 in accordance with the previous embodiment enter the element 1a and arrive at the reflection surfaces 8 extending annularly about the axis 14 of the element 1a and enclosing an acute angle opening towards the light exit side 15 of the element with the axis 14. The reflection surfaces 8 lie parallel to each other and are connected to each other by annular surfaces 16 inclined contrary to them. The reflection and annular surfaces 8, 16 are provided on the underside 7 of the element 1a opposed to the light exit side 15, which element 1a is of trapezoidal cross-section. The light exit side 15 has a greater diameter than the underside 7.

[0019] The light rays L emanating from the LED 2 are so reflected at the reflection surfaces 8 that they exit parallel to each other perpendicularly from the light exit side 15 of the element 1a. The reflection surfaces 8 may alternatively be so arranged and configured that the light rays L do not run parallel to each other after reflection.

[0020] In this embodiment also, essentially all of the light emanating from the LED 2 is picked up by the element 1a. It has but little thickness, corresponding substantially to the height of the LED 2. The element 1a is, therefore, eminently suitable if but little installation depth is available.

[0021] As Fig. 3 shows, the light-conducting element 1a according to Fig. 2 may be combined with a reflector 1 according to Fig. 1. The element 1a lies a short distance behind the reflector 1 in beam direction, at the level of a central aperture 12 through which the LED 2 projects. The diameter of this aperture 12 matches the diameter of the light-conducting element 1a on the light exit side 15.

[0022] The LED 2 of the light-conducting element 1a is located behind the LED 2 of the reflector 1. The reflection surfaces 8 of the element 1a are so arranged that the light L' coupled into the element 1a from the LED 2 reaches through the aperture 12 of the reflector 1. The rays of light L, L' run parallel to each other towards the light disk of the lamp. In this way, the light disk is optimally and uniformly deflected.

[0023] The LED 2 of the element 1a with base 3 is so arranged with respect to the reflection surfaces 8 that the light rays L' emitted by the LED

reach the reflection surfaces 8 without hindrance by the base 3. The reflection surfaces 8 in turn are so arranged that the rays of light reflected by them will pass by the base 3 of the LED 2 of the reflector 1.

[0024] The LEDs 2 may emit light of the same or different color. For example, one LED 2 may emit red and the other LED 2 yellow. Such a configuration is provided when the two LEDs 2 are employed for the brake light and the blinker. The two LEDs 2 are then actuated according to the desired signal function. Alternatively, of course, both LEDs may emit red or both yellow, to enhance the intensity. Alternatively again, the LEDs 2 may be used for the closure light, the fog light or the reverse light. In that case, the LEDs will emit the appropriate hue.

[0025] Fig. 4 shows an embodiment in which the two light-conducting elements 1a, 1a' are closely spaced one behind the other. The two elements 1a, 1a' are of essentially the same configuration as the element 1a according to Fig. 2. The reflection surfaces 8 on the underside 7 are spaced farther from each other than in the embodiment of Fig. 2. The reflection surfaces 8' of the element 1a are spaced farther apart than the reflection surfaces 8, and are so arranged relative to these reflection surfaces that the rays L' emanating from the bottom element 1a' exit between the rays L of the top element 1a. In the region where the light rays L' of the element 1a' reach the underside 7 of the top element 1a, there are no reflection surfaces 8. The rays L' impinge perpendicularly on the underside 7 of the element 1a and pierce it, emerging perpendicularly from the light exit side 15 of the element

1a. Thus, in simple manner, a uniform intensive emission is assured. Since both elements 1a, 1a' have but little thickness, the corresponding lamp is distinguished also by a small structural height. The LEDs 2 may emit light of like or unlike color.

[0026] In the embodiment according to Fig. 4, an additional light-conducting element (not shown) may be provided, of similar configuration to the other two elements 1a, 1a'. The reflection surfaces of this additional light-conducting element are so arranged relative to the reflection surfaces 8, 8' that the rays reflected by them pass between the rays L, L' of the other two elements 1a, 1a'. The underside 7' of the element 1a' is even in the region of these perpendicularly incident rays. Thus, an additional enhancement of intensity can be achieved. Besides, all three LEDs may then be of different colors, so that the corresponding lamp may, for example, comprise a brake light, a closure light and a blinker.

[0027] Fig. 5 shows an embodiment in which the reflector 1 is arranged behind the light-conducting element 1a in beam direction. The LED 2 and the reflector 1 itself are so configured and arranged relative to each other that the rays L reflected from the reflector surface 6 pass between the reflection surfaces 8 of the element 1a. In the region of the rays L' impinging perpendicularly on the underside 7 of the element 1a, no reflection surfaces 8 are provided. The light rays L traverse the element 1a and emerge perpendicularly from its light exit side 15.

[0028] The reflector surface 6 of the reflector 1 may, as shown in the left-hand half, be of smooth configuration. Alternatively, however, as shown in the right-hand half of Fig. 5, it may be provided with optics 11, for example in the form of roller or cushion optics.

[0029] With the reflecting parts 1, 1a located one close behind the other, a high intensity of light is achieved. The reflector 1 and the light-conducting element 1a are of substantially the same diameter, and each of but little height.

[0030] The light-conducting element 1b according to Fig. 6 largely corresponds to the element according to Fig. 2. It differs from the latter in that, on the underside 7b, a cooling member 10, 10b is provided. Fig. 6 shows two embodiments, by way of example, of a cooling member. In the right-hand half of Fig. 6, the cooling member 10b is disk-shaped, covering the entire underside 7b of the light-conducting element 1b. Alternatively, as shown in the left-hand half of Fig. 6, the cooling member 10 may be of thickened configuration in the central portion 17 underneath the LED 2. This cooling member region 17 has the same diameter as the opening 13 in which the LED 2 is located. Starting out from the cooling member region 17, the thickness of the cooling member 10 diminishes as far as the outer edge of the underside 7. This diminution of thickness may be continuous or else, as shown in Fig. 6, first greater and then less towards the outer edge. In the region of the LED 2 where the greatest evolution of heat occurs, the heat can be reliably carried off by the cooling member region 17.

[0031] Incidentally, the element 1b is of like configuration as the embodiment according to Fig. 2. The cooling member may of course alternatively be provided in the embodiments according to Figs. 3 to 5.

[0032] The light-conducting element may advantageously consist of polymethyl methacrylate. The side wall 9 of the light-conducting elements 1a, 1a', 1b is advantageously provided with a reflection layer by vapor deposition, so that the light rays cannot exit from the light-conducting element laterally.

[0033] Instead of the ribbed LEDs represented and described, unribbed LEDs may be employed, likewise emitting the light laterally. Such LEDs are known and, therefore, are not described in more detail.

[0034] The description of the invention is merely exemplary in nature and, thus, variations that do not depart from the gist of the invention are intended to be within the scope of the invention. Such variations are not to be regarded as a departure from the spirit and scope of the invention.